NHDES

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
(603) 271-3406 FAX (603) 271-7894

Mr. Rodney Bartlett
Public Works Dept.
Town of Salem
21 Cross Street
Salem, NH 03079

June 18, 2002
Letter of Deficiency
DAM #209.05

RE: Arlington Reservoir Dam, Salem

Dear Mr. Bartlett:

The Department of Environmental Services, Dam Bureau (DES) consistently strives to enhance the safety of dams in New Hampshire through its dam safety program. One of the many instruments that play a part in reaching this goal is our inspection program. DES is forwarding this correspondence to you to advise you that in accordance with RSA 482:12 and Env-Wr 502.02, an inspection of the subject dam was conducted on March 8, 2002. During this visual inspection and/or file review, the following deficiencies were observed:

There is tree and brush growth on the right and left earthen embankments on both upstream and downstream faces. The rip rap on the upstream faces is overgrown;

2. There is insufficient grass cover on the dam crest to the right of the concrete gravity section;

3. There is significant soil erosion at the contact of the right concrete gravity section and earthen embankment. The crest width of the embankment in this area is approximately 6 inches. According to the plans on file with the DES, the earth embankment has a minimum crest width of 9 feet. In addition, there is an exposed electrical conduit and wires to the right of the concrete gravity section. This condition has existed since at least the 2000 inspection;

4. There is concrete spalling on the downstream face of the dam to the right of the gate house structure;

5. There is spalling of the gunite surface on the downstream face of the gate house. The inspection photos indicate that the spalling of the gunite surface has continued to deteriorate since the 2000 inspection. The condition of the underlying concrete is unknown;

6. There is spalling on the downstream face of the dam between the spillway and gate house. Previous inspections indicated seepage through the concrete dam. At the time of this inspection the pool was lowered for fall drawdown resulting in no observed seepage;

7. There is eroded concrete to the left of the low level outlet pipe at the left downstream corner of the gate house structure. Inspection photos indicate that concrete deterioration in this area has increased since the 2000 inspection. The condition and structural integrity of the underlying concrete is unknown;

8. There is concrete spalling at the right downstream corner of the gatehouse structure just above the contact with the earthen downstream toe. Inspection photos indicate that this deterioration has continued to worsen since the 2000 inspection;

9. The concrete spillway steps are heavily eroded. Inspection photographs indicate that the concrete erosion has increased since the last inspection;

10. There is spalled concrete at several locations on the downstream face to the left of the spillway channel;

11. There is soil erosion at the contact of the left concrete gravity section with the earthen embankment (earth crest eroded approximately 1 foot below concrete crest). The soil erosion begins on the upstream face, continues over the crest, and down the downstream face. Heavy foot traffic appears to be the leading cause of this erosion. There is also soil erosion/foot path on the upstream face of the embankment located approximately 20 feet left of the concrete upstream face;

12. There is spalled concrete and 1/16 inch wide surface cracks on the concrete dam crest approximately 6 feet to the left of the spillway;

13. The security fence on the left concrete gravity section is damaged on the upstream face allowing access to the spillway. This fence has further been vandalized since the 2000 inspection;

14. There are no as-built plans of the dam on file. The as-built configuration of the spillway crest and flashboards system is in question. In addition, it is unclear as to the extent of the repairs that got completed during the early 1980's rehabilitation;

15. The configuration of the flashboards system is in question. The design calls for 2.5 feet of flashboards, however, it is reported that there is a concrete lip upstream of the boards reducing the actual height of the boards to 2.0 feet. If this is true, the boards will not fail at the design heads;

16. A file review raised questions about the stability of the dam. Several different stability calculations have been done with varying assumptions resulting in a factor of safety for overturning ranging from 1.09 to 2.0;

7. Photos of the spillway taken in 1996, with approximately 2 inches of flow over the boards, show flow almost overtopping the left downstream concrete training wall and shows flow in the wooded area to the left of the spillway discharge channel;

18. Downstream channel between the dam and the stream gage is overgrown;

19. The annual test of the emergency action plan (EAP) and update of the notification flowchart has not been completed since 1997; and

20. There is no maintenance plan on file with the DES.

DES is requesting that you submit a schedule of repair within 30 days to address the following deficiencies. If DES does not receive this schedule in the time frame indicated above, we will initiate the Administrative Order process:

1 Update and test the EAP. It is imperative that the EAP and evacuation procedures be kept up to date. The last test was conducted in January of 1997;

2. Regrade and establish ground cover on the right and left embankments at the contacts of the concrete crest and earth embankments. The plans on file indicate that the earth embankment crest should be a minimum of 9 feet wide and at elevation 169 feet. Both embankment crests should be surveyed to confirm that they are at their design elevation;

3. Remove the brush and tree growth at the following locations:
    a. Left earthen embankment, which extends approximately 100 feet to the East of the contact with the concrete section, on both the upstream and downstream faces from the spillway to the left abutment;
    b. Right earthen embankment, which extends approximately 180 feet to the West of the contact with the concrete section, on both the upstream and downstream faces (i.e. along the access road from the security fence to the gate);

4. Repair the entire downstream face of the dam. At the direction of a New Hampshire licensed professional engineer, repairs at a minimum should include removing the gunite surfacing and underlying concrete until sound concrete is exposed and re-surface the downstream face as necessary. In addition, the source of seepage exiting the downstream face should be investigated and repaired in conjunction with the concrete repairs. The following is a list of areas that show visible signs of deterioration:

    a. Downstream face of the dam to the right of the gate house structure;
    b. On the downstream face of the gatehouse;
    c. Downstream face between the gate house and spillway;
    d. Downstream left corner of the gatehouse foundation to the left of the low level outlet pipe;
    e. Right downstream corner of the gate house at the contact with the earthen downstream toe;
    f. Spillway steps across the entire length of the spillway;
    g. Downstream face to the left of the spillway;
    h. On the crest of the dam 6 feet to the left of the spillway;

5. Repair the security fence on the left concrete crest;

6. Prepare and submit as-built plans of the dam and spillway section paying specific attention to the configuration of the flashboard system. In addition the plans should attempt to delineate the extent of repairs conducted during the early 1980's rehabilitation project. The file indicates that there was 9 inches of eroded concrete on the downstream face of the dam. It is unclear if this 9 inches of concrete was replaced prior to the gunite surfacing project;

7. If the as-built plans show that the flashboards were not constructed as designed, conduct an analysis of the flashboard pins to ensure they fail at the design heads;

8. Conduct a stability analysis on the dam. At a minimum the factor of safety for overturning and sliding should be determined;

9. Model the hydraulic grade line during the design event to determine if the left spillway training wall and natural bedrock to the left of the spillway provide adequate protection for the left embankment during high runoff events. Historical photos indicate that trees on the left slope become inundated with as little as 2 inches of flow over the flashboards. The discharge channel should be armored as necessary based on the results of the analysis;

10. Prepare and submit a maintenance plan. At a minimum, the maintenance plan needs to include provisions for annual mowing of the embankments, monitoring and repairing soil erosion on the embankments due to heavy use by the public, monitoring and repairing of the security fences.

Due to the time that has lapsed as well as additional deficiencies observed as a result of the March 8, 2002 inspection, DES will be officially closing out the February 1999 LOD as well as the reissued version dated September 2000. Enclosed are copies for your reference. It is our hope that the additional deficiencies as well as the outstanding deficiencies will be addressed. DES would like to inform you at this time that most of the conditions that were outlined in our previous LOD's continue to worsen and by delaying the repairs any further could eventually lead to the failure of the dam. Please be aware that DES will be requiring a dam reconstruction permit for the items listed above.

DES is requesting that you complete and submit the attached "Intent to Complete Repairs" form, within 30 days of receipt of this letter, that will provide for correction of the identified deficiencies by the date(s) indicated above. If you believe changes to the items of work or dates are necessary, please make the changes directly on the form and provide a brief explanation. We have enclosed a self addressed stamped envelope for you to return this form.

Our intent in sending you this correspondence is to make you aware of items that DES believes warrant your attention to insure the continued safe operation of your dam. It is our hope that, through the submittal of the attached form and a commitment to keeping a well-maintained dam, you will voluntarily comply with the requested items of work. If we do not receive your proposed schedule to complete the above deficiencies within 30 days, DES will issue an Administrative Order requiring that the items be addressed in a timely manner.

If you have any questions or comments regarding this Letter of Deficiency or would like to be present at future inspections, please contact me at 271-3406, or write to the Water Division at the address listed on the top of the previous page.

Sincerely,

Jeffrey M. Blaney
Dam Safety Engineer

Attachments: Application to Construct/Reconstruct a Dam, Copy of February 1999 LOD, Copy of September 2000 Reissued LOD, Guideline for an O&M plan, DB8, DB13

cc: HTE
Gretchen Rule
Town of Salem

Certified # 7000 1670 0000 0586 0387

JMB/was/h:/safety/wendy/lod/209-05blod.doc